

# PATENT SPECIFICATION

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## (54) "IMPROVEMENTS IN OR RELATING TO HEAT SEALER APPARATUS"

(71) We, MOORE BUSINESS FORMS LIMITED (formerly Lamson Industries Limited) British company of 75/79 Southwark Street, London SE1 0HY, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates generally to a heat sealer apparatus, and more particularly to such an apparatus for the localized heating of hot melt adhesive between superimposed plies of a continuous business form.

The multiple plies of series connected continuous business forms are often adhesively secured together by means of hot melt adhesive which must be heated for activation thereof. For such purpose, the continuous forms are typically moved through some type of heat source. Such a heating approach, while effective in activating the hot melt adhesive, is nevertheless costly and inefficient mainly because of the wasted thermal energy involved in having to heat the entire form. Moreover, the form must be supported as it passes through the heat source, such support thereby also becoming heated and possibly resulting in scorching of the web if extreme care is not taken.

It is therefore an object of the present invention to provide an improved apparatus for heat sealing.

It is another object of the present invention to provide a heat sealing apparatus capable of sealing together multiple plies of a continuous form by utilizing a minimum amount of thermal energy for activating the hot melt adhesive while at the same time supporting the moving form directly on a plurality of heating elements themselves.

According to the present invention heat

sealer apparatus for continuous business forms comprises a plurality of elongated heating elements mounted in parallel spaced — apart relationship for supporting a multiple ply continuous business form movable along the length of said elements for the localized heating of hot melt adhesive disposed between the plies, means for advancing the continuous form, a processing means disposed downstream of said heating elements for bringing the heated plies into intimate contact with one another and a speed control connected to the form advancing means wherein the heating elements are operatively coupled with the speed control through a variable power control system so as to increase and decrease power input for the heating elements respectively in accordance with increase and decrease in the speed of the continuous form whereby a substantially constant thermal energy transfer is effected.

A heat sealer apparatus according to the present invention will now be described by way of example with reference to the accompanying drawings wherein:—

Figure 1 is a perspective view of the apparatus in accordance with the invention shown in conjunction with a continuous business form; and

Figure 2 is a sectional view of the apparatus taken substantially along the line 2-2 of Figure 1.

Turning now to the drawings wherein like reference characters refer to like and corresponding parts throughout the several views, a heat sealer apparatus generally designated 10 is shown in the drawings as comprising a plurality of elongated heating ribbons or elements 11 lying parallel to each other and to the direction of travel of a business form F as shown by the arrow in Figure 2. The heating elements are

transversely spaced apart and are mounted on an arcuate platen 12 of a generally convex shape as shown. The heating elements or ribbons may be of a Nichrome (Registered Trade Mark) or other suitable electrical resistance material, and platen 12 may be constructed generally of materials having low specific heat constants such as a phenolic resin or ceramic, which are also electrically non-conductive and which can be fabricated to the desired shape. Guide plates 13 likewise of materials having low specific heat constants, are mounted along opposite side edges of the platen, and extend upwardly thereof so as to form suitable guides for business form F. Such form is shown in the drawings as being of a two-ply construction with its upper ply 14 folded longitudinally along its centerline over a lower ply 15. Such a folding is typically carried out by means of a gradually converging fold plate (not shown) through which the flat paper web is drawn for effectively folding it along its longitudinal centerline. Of course, multiple plies of other type of forms constructions can be heat sealed together with the use of the present apparatus without departing from the scope of the invention.

Spots of hot melt adhesive such as shown at 16 are provided adjacent transverse lines 17 of weakening which are provided in the form for separating it into individual units U as the form proceeds through a bursting machine or the like. The particular form shown in Figure 1 is also provided with feed bands 18 and 19 each having spaced marginal feed holes therein.

The bands are removable from the web along lines 22 and 23 of weakening. And, a glue stream 16a may be provided between the superimposed feed bands inwardly of their feed holes as shown so that each unit defines an envelope sealed along glue spots 16 and glue stream 16a on three sides, and connected along a line of weakening at the central fold line. Also, similar glue streams may be provided adjacent the transverse lines 17 of weakening in lieu of glue spots 16. Therefore, after the superimposed plies of the business form are secured together, units U are separated from one another so as to form an envelope which can be easily opened by simply removing the tear strip comprised of the attached feed bands, and thereafter peeling the plies apart so as to break the adhesive therebetween. As noted above, the longitudinal centerline along which the plies are folded may likewise comprise a line of weakening so that the plies may be completely separated upon tearing along such line.

Means for pressing together the folds of the form downstream of the heating elements may include a pair of cooperating squeeze rolls 24 and 25, rotatably driven by some suitable means (not shown). The nip between these rolls occupies the same plane as the upper surface of the heating elements at their downstream ends so that the folded-over form may pass through this nip as in a manner to be hereinafter des-

cribed. Pressure platens (not shown) may be alternatively provided in lieu of squeeze rolls for pressing the folds together in a similar manner.

Also, a tractor pin feed device 26 is disposed downstream of the squeeze rolls, such device being of standard construction as comprising an endless movable band having feed pins 27 thereon of equal spacing to that of feed holes 21 for engaging these holes so as to move the folded business form in the direction of the arrow shown in Figure 1. This tractor device may be a part of the detacher mechanical drive normally provided for advancing the form. A Variable Power Control system 29 for the heating elements may be operatively coupled with the Speed Control 31 of the detacher mechanism, as shown in the drawings, in such a manner as to increase/decrease power input for the heating elements in accordance with increase/decrease in web speed.

In operation, the folded-over business form is advanced in a forward direction by means of the tractor pin feed device so as to cause the form to slidably engage the heating elements and to move through the nip between the squeeze rolls. The heating elements are so arranged as to be disposed directly beneath spots 16 of adhesive as well as beneath glue stream 16a. Otherwise, if glue streams are used in lieu of glue spots 16, the heating elements may be simply disposed therebeneath for melting and thus activating a portion of these transverse glue streams during web movements. By reason of the coupling between system 29 and Speed Control 31, and the low thermal capacity of the elements a fast thermal response of the heating means is effected thereby avoiding any delay or "warm-up" time necessary to effect sealing from minimum to maximum web speed. Also, a secondary quiescent control is maintained on the heating ribbons while the apparatus is stopped so as to thereby maintain a sealing at a minimum level so that any localized scorching of the web is substantially avoided. The heating elements actually support the form as it moves forwardly, and spots 16 of adhesive as well as glue streams 16a are melted and thus activated as the heating elements locally heat only those portions of the overlying form lying thereagainst. By reason of the arcuate shape of the heating elements, the form is caused to advance in close contact with the heating elements and a hold-down screen 28, which may be of an open-mesh Teflon (Registered Trade Mark)-covered Fiberglass construction, may be disposed over the entire arcuate surface of the heating elements. Therefore, the folded over web passing beneath the screen is therefore maintained in intimate contact with the heating elements not only by reason of the arcuate shape thereof, but also by the hold-down feature of the screen which assures positive intimate sliding contact between the web and the heating elements. For example,

creases in the form between units U are caused to be flattened by screen 28. And, as the form advances forwardly, it then passes through the nip between squeeze rolls 24 and 25 for bringing the heated web into intimate contact

5 between its adjacent folded surfaces so as to complete the perimeter fastening. The form then advances through a burster or the like for separating units U therefrom.  
10 From the foregoing it can be seen that a simple and economical and yet highly effective heat sealer apparatus has been devised for continuous business forms. A full perimeter sealing of the folded-over plies is effected by  
15 means of a series of heating ribbons disposed in parallel over an arcuate platen, such ribbons constituting a heating means from a source (not shown) to effect localized melting of the heat seal adhesive during the time required to  
20 transfer energy from each ribbon, through the paper web, and to the hot melt adhesive in a local area directly above each ribbon between the upstream ends of the ribbons and the down-  
25 stream ends thereof. The forms are fed by conventional pin-feed means, which may be integral with the present apparatus or which may be a part of the adjacent unit, such as a burster or an imprinter (not shown).

The web, with its adhesive areas softened as  
30 described, passes from the heating zone at the downstream ends of the heating elements and through a pressing means which bring the web so heated into intimate contact between its adjacent folded faces so as to complete the  
35 perimeter fastening operation.

Obviously, many modifications and variations of the invention are made possible in the light of the above teachings. It is therefore to be understood that within the scope of the  
40 appended claims the invention may be practiced otherwise than as specifically described.

#### WHAT WE CLAIM IS:-

1. A sealer apparatus for continuous forms comprising a plurality of elongated heating  
45 elements mounted in parallel spaced - apart relationship for supporting a multiple ply continuous business form movable along the length of said elements for the localized heating of hot melt adhesive disposed between the plies,  
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means for advancing the continuous form, a processing means disposed downstream of said heating elements for bringing the heated plies into intimate contact with one another and a speed control connected to the form advancing  
60 means wherein the heating elements are operatively coupled with the speed control through a variable power control system so as to increase and decrease power input for the heating elements respectively in accordance  
65 with increase and decrease in the speed of the continuous form whereby a substantially constant thermal energy transfer is effected.

2. The apparatus according to Claim 1, wherein the heating elements are convexly  
70 curved between their ends and a convexly curved platen is mounted beneath said heating elements parallel thereto, and upwardly extending guide plates are provided along opposite  
75 sides of said platen for guiding the form during its movement toward said rolls.

3. The apparatus according to Claim 1, wherein a heat resistant open-mesh screen is mounted in place over said heating elements for pressing the form against said elements while  
80 passing beneath said screen.

4. The apparatus according to Claim 1, wherein said heating elements are of low thermal capacity whereby the substantially  
85 constant thermal energy transfer is effected to said adhesive without significant thermal delay time.

5. A heat sealer apparatus for continuous business forms constructed, arranged and adapted to operate substantially as herein des-  
90 cribed with reference to the accompanying drawings.

FOR THE APPLICANTS

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D.T. TOWNSEND  
Chartered Patent Agent  
Moore Business Forms Limited  
75-79 Southward Street  
London SE1 OHY

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